

REMARKS

The above amendments to the above-captioned application along with the following remarks are being submitted as a partial response to the Official Action dated August 16, 2005. In view of the above amendments and the following remarks, the Examiner is respectfully requested to give due reconsideration to this application, to indicate the allowability of the claims, and to pass this case to issue.

Status of the Claims

Claims 1-18 are under consideration in this application. Claims 1, 3, 5, 7-8, 10-12, 14-15 and 17-18 are being amended, as set forth above and in the attached marked-up presentation of the claim amendments, in order to more particularly define and distinctly claim Applicants' invention.

All the amendments to the claims are supported by the specification. Applicants hereby submit that no new matter is being introduced into the application through the submission of this response.

Formality Rejection

Claim 18 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite on the grounds that language in the claim was lacking in proper antecedent basis.

As indicated, claim 18 is being amended as required by the Examiner. Accordingly, the withdrawal of the outstanding informality rejection is in order, and is therefore respectfully solicited.

Allowed Subject Matter

Claims 5-10 and 12-17 would be allowed if rewritten into independent form to include the limitations of their base claim and any intervening claims.

Prior Art Rejections

Claims 1-4 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,463,501 to Kern et al. (hereinafter "Kern") in view of US Patent No. 6,195,695 to Cheston et al. (hereinafter "Cheston"), and claim 18 as being unpatentable over Kern, in view of Cheston, and further in view of US Patent No. 6,526,419 to Burton et al. (hereinafter "Burton"). The prior art references made of record but not cited against the application are cited as being pertinent to the disclosure of the invention. The above

rejections have been carefully considered, but are most respectfully traversed in view of the newly submitted claims, as more fully discussed below.

As now recited in the claim 1 (for example, the embodiment shown in Figs. 12-13; pp. 30-32), the disk control apparatus 10 of the invention connected to an information processing apparatus 20 so as to communicate with the information processing apparatus 20. The disk control apparatus 10 writes/reads data into/from a first storage device 1201 (for storing original data) having one or more logical volumes formed thereon, a second storage device 1202 (for storing replica) having one or more logical volumes formed thereon, and a third storage device 1203 (for storing journal data; *“If a hardware fault has occurred in a hard disk drive 120 included in the first storage device 1201, the data in the logical volume 121 in the first storage device 1201 can be restored by using the logical volume 121 in the second storage device 1202 and the journal data 1701 stored in the third storage”* p. 50, lines 4-9; *“the invention reduces the conventional 3rd storage capacity from 100% to 25 % if the update quantity per day is less than 20%”* p. 47, lines 7-25). The disk control apparatus 10 comprises: a memory 133 in Fig. 1 or 1003 in Fig. 12, association of identifiers of the logical volumes 121 in said first storage device 1201 serving as identifiers of primary logical volumes with identifiers of the logical volumes 121 in said second storage device 1202 serving as identifiers of secondary logical volumes being stored in said memory as a pair management table 1501 in Fig. 13; a timing mechanism 1204; a write request reception unit 1301 for receiving a write request of update data for a logical volume 121 in said first storage device 1201 and the update data to be written, from the information processing apparatus 20; a first write unit 1302 (Fig. 20; p. 36, line 20 to p. 40, line 6) responsive to reception of the write request, for writing the update data into the logical volume 121 in said first storage device 1201 (*“Upon receiving the update request, the disk control device 110 writes update data into the logical volume in the first storage device 1201.”* P. 31, lines 5-7); a journal write unit 1301 (p. 40, line 7 to p. 41, line 7) for writing journal data 1701 (Fig. 17) into said third storage device 1203, each of the journal data 1701 comprising an identifier of a respective logical volume 121 in said first storage device 1201 into which the journal data has been written, information of a location in which the journal data is stored in the respective logical volume 121, a update time which is a current time acquired from said timing mechanism 1204, and update data (p. 31, lines 8-12); and a second write unit 1304 (Fig. 23; p. 43, line 5 to p. 44, line 18; *“When updating the logical volume 121 in the second storage device 1202 by using the journal data 1701 stored in the third storage device 1203, it is not necessary to read out data from the first storage device 1201.”* p. 49, lines 24-28) for referring to the

update time of the journal data 1701 stored in said third storage device 1203, selecting at least one of the journal data 1701 for which a difference between a respective current time acquired from said timing mechanism 1204 and the update time is longer than a predetermined time 1205 (*"If there are a plurality of journal data 1701, the second write unit 1304 writes the update data in the logical volume 121 in the second storage device 1202 in the order of sequence ID, i.e., in the order of update time."* P. 44, lines 5-9), referring to an identifier of the logical volume in the selected journal data, the location information and the update data therein in an updating time order, acquiring an identifier of a secondary logical volume corresponding to the identifier of the logical volume in the selected journal data in the pair management table 1501, and writing the update data in the selected journal data into a place indicated by the location information in the selected journal data, which is a logical volume indicated by the identifier of the secondary logical volume, in said second storage device 1202 (*"the disk control device 110 writes the update data into the logical volume 121 in the second storage device in the order of the update time."* P. 31, lines 17-19).

The invention recited in claim 11 is directed to a control method for the disk control apparatus 10 recited in claim 1.

The invention recited in claim 18 is directed to a disk control apparatus 10 comprising: a channel control unit 131 for receiving a data write request for the logical volume from the information processing apparatus 20; a disk control unit 132 for writing the data received by said channel control unit 131 into the logical volume; a switching control unit 135 for connecting said channel control unit 131, said disk control unit 132 and a shared memory 133 so as to conduct communication; and the journal write unit 1303; and the second write unit 1304 recited in claim 1.

As admitted by the Examiner (p. 6, 2nd paragraph of the outstanding Office Action), Kern does not disclose such a second write unit as recited in claim 1 of the application.

Cheston was relied upon by the Examiner to teach the second write unit of the invention. However, Cheston fails to compensate for Kern's deficiencies. Cheston merely updates a full backup copy (100% replica volume) stored in a second storage device periodically (e.g., once a week) or "after a predetermined amount of time has passed (col. 4, lines 36-36)," rather than writes just update data (data being written into/updated in the logical volume of said first storage device; e.g., the update quantity per day is less than 20% of a replica volume, p. 47, lines 20-22) into a second storage device after a predetermined time has passed from the update time.

In addition, Cheston merely updates the backup copy with the most recent ONE version at the time of updating, rather than writing ONE OR MORE *update data* into a second storage device. As such, Cheston does not "select at least one of a plurality of journal data for which a difference between current time acquired from said timing mechanism and the update time is longer than a predetermined time, and then refers them in an updating time order to write the update data thereof into a second storage device" (*"If there are a plurality of journal data 1701, the second write unit 1304 writes the update data in the logical volume 121 in the second storage device 1202 in the order of sequence ID, i.e., in the order of update time."* P. 44, lines 5-9). As a result, journal data other than the above journal data are NOT selected and their update date is not written into the second storage device. Therefore, illegal data accidentally written into the first storage device will not be written into the second storage device (p. 46, lines 5-14).

Borton was relied upon by the Examiner to teach claim 18. However, Borton fails to compensate for Cheston's deficiencies regarding claim 1 as discussed above. Burton deploys a shadow pair (Abstract), i.e., TWO sets of replica, rather than just ONE replica and a third storage device for storing journal data (including mainly update data).

Applicants contend that neither Kern, Cheston, Borton, nor their combinations teaches or discloses each and every feature of the present invention as disclosed in independent claims 1, 11 and 18. As such, the present invention as now claimed is distinguishable and thereby allowable over the rejections raised in the Office Action. The withdrawal of the outstanding prior art rejections is in order, and is respectfully solicited.

Conclusion

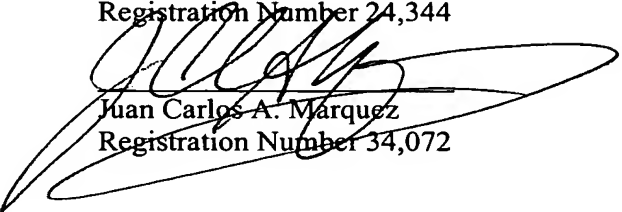
In view of all the above, clear and distinct differences as discussed exist between the present invention as now claimed and the prior art reference upon which the rejections in the Office Action rely, Applicants respectfully contend that the prior art references cannot anticipate the present invention or render the present invention obvious. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

Favorable reconsideration of this application is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance

of the above-captioned application, the Examiner is invited to contact the Applicants' undersigned representative at the address and phone number indicated below.

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